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H01Q 1/24

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US 5373304 A

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(54) Abstract Title
Antenna with rf energy shield for a portable cellular phone

(57) An antenna having a core 20 holding a winding assembly on the inside for receiving/transmitting radio signal, and a resin shell 90 moulded on the core, wherein a shield 30 (preferably metal) is embedded in the resin shell and covers one half of the periphery of the core to limit the direction of radiation of the high frequency energy emitted from the winding assembly. Thus reducing the amount of RF energy radiated into the users head. In one embodiment the shield can be rotated with the core and the shell on a mounting member attached to a mobile phone. This rotation is ratcheted see fig 9.

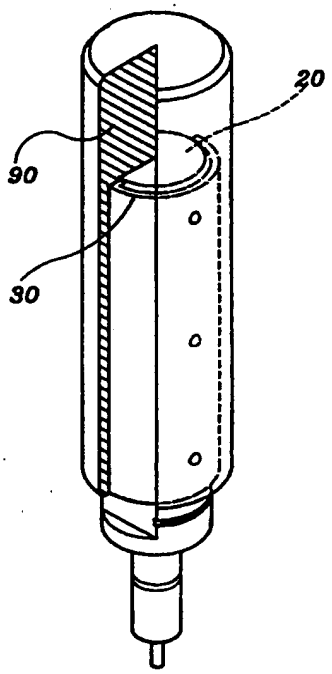

FIG. 6

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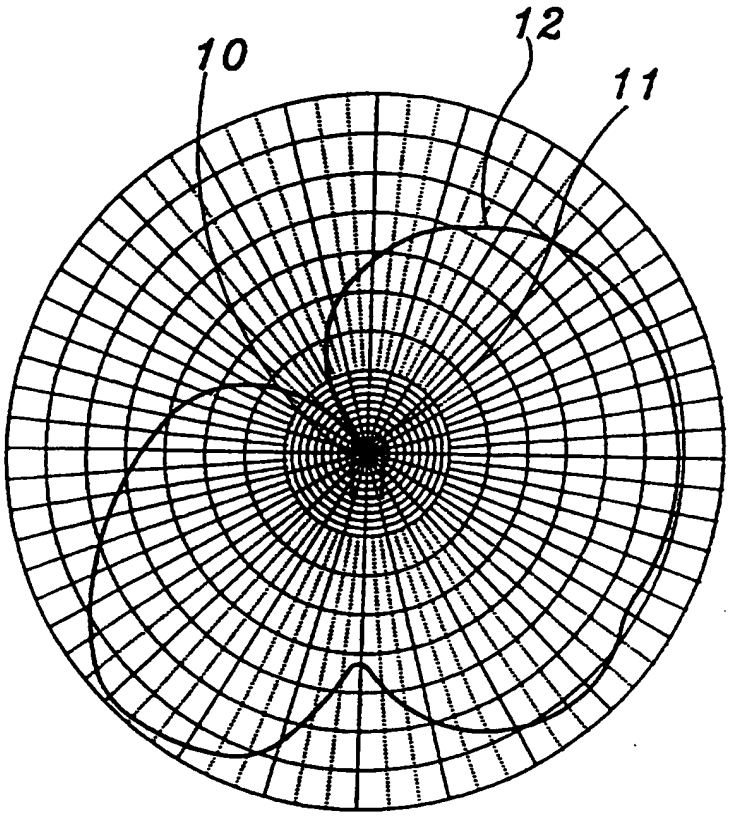

FIG. 1

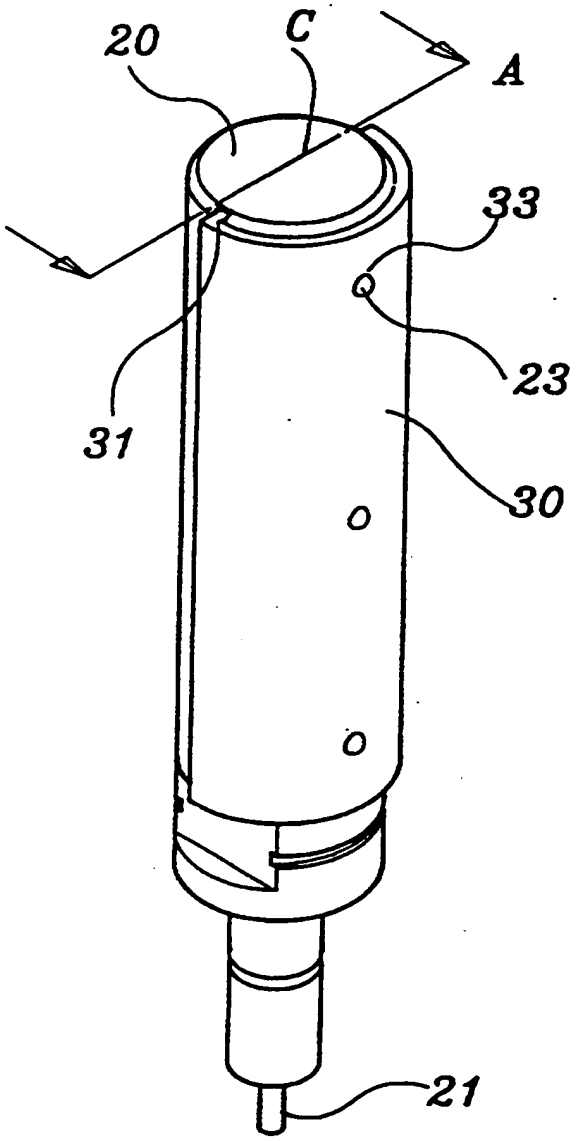

FIG. 2

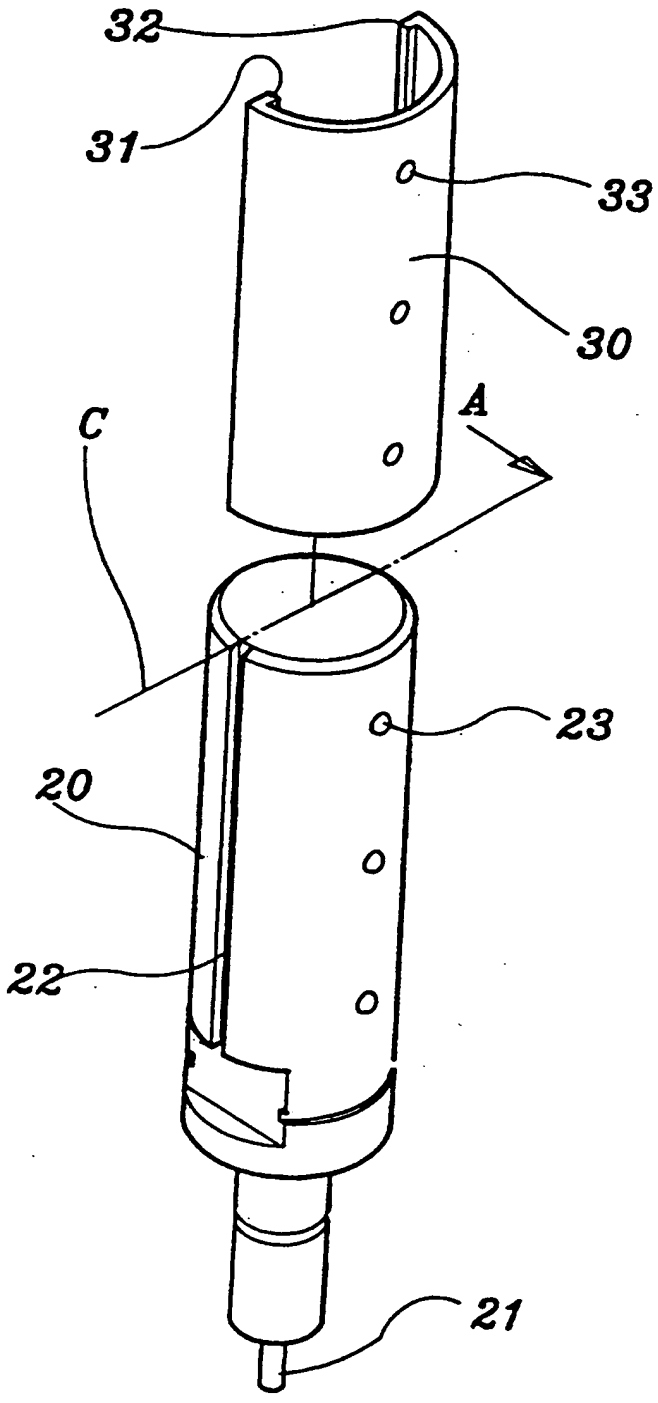

FIG. 3

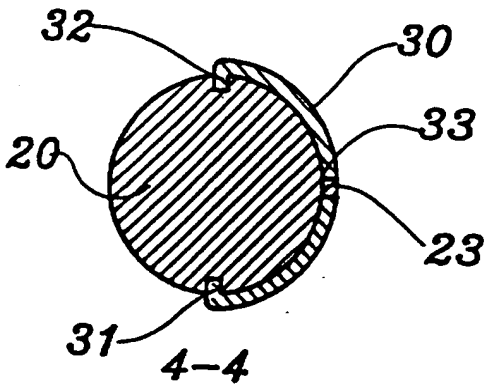

FIG. 5

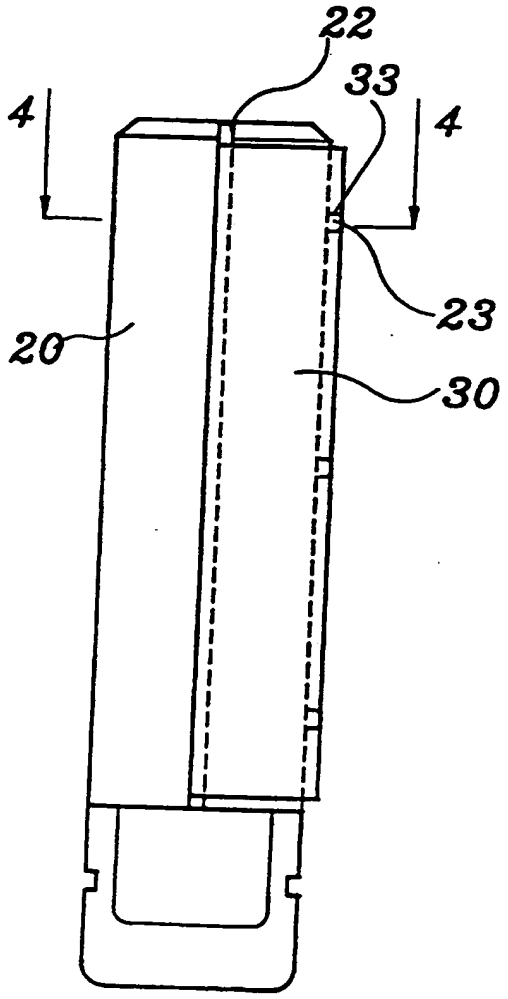

FIG. 4

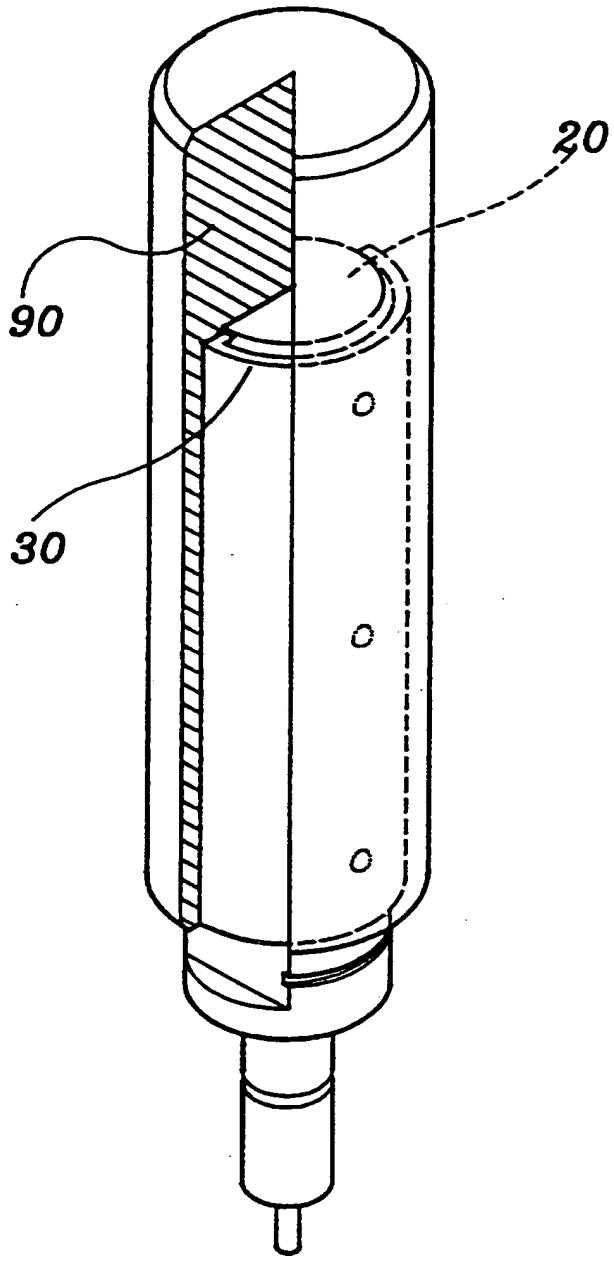

FIG. 6

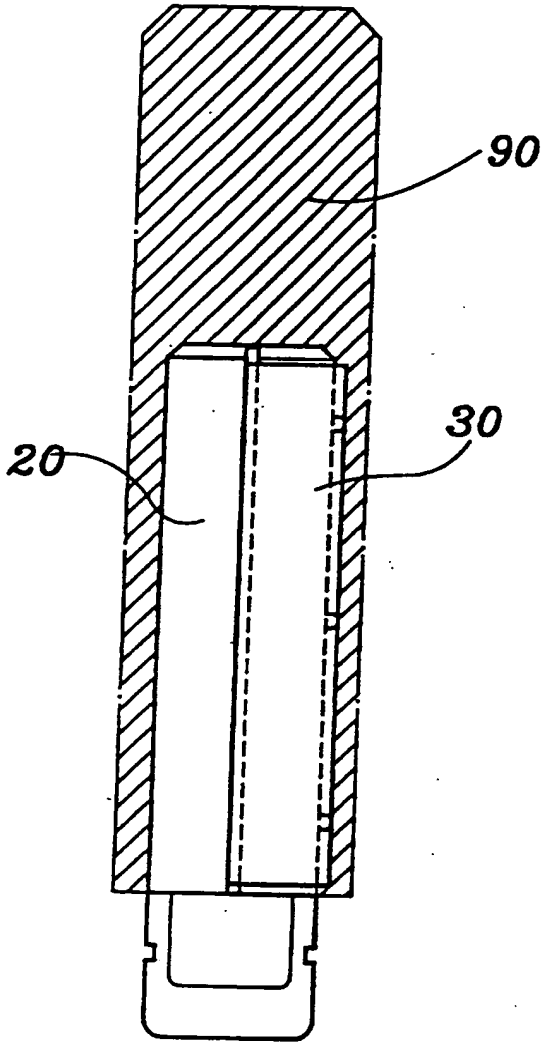

FIG. 7

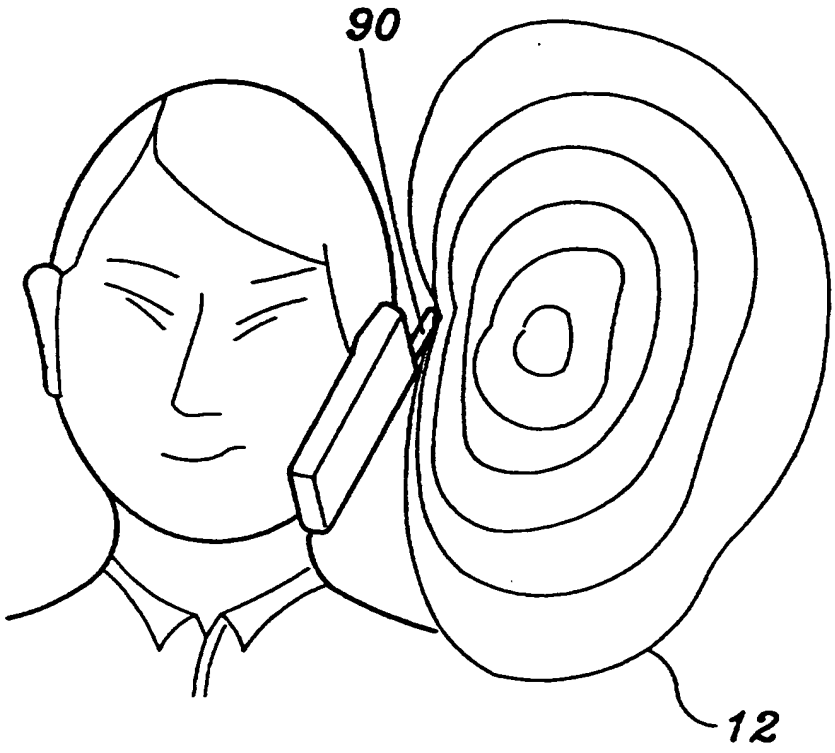

FIG. 8

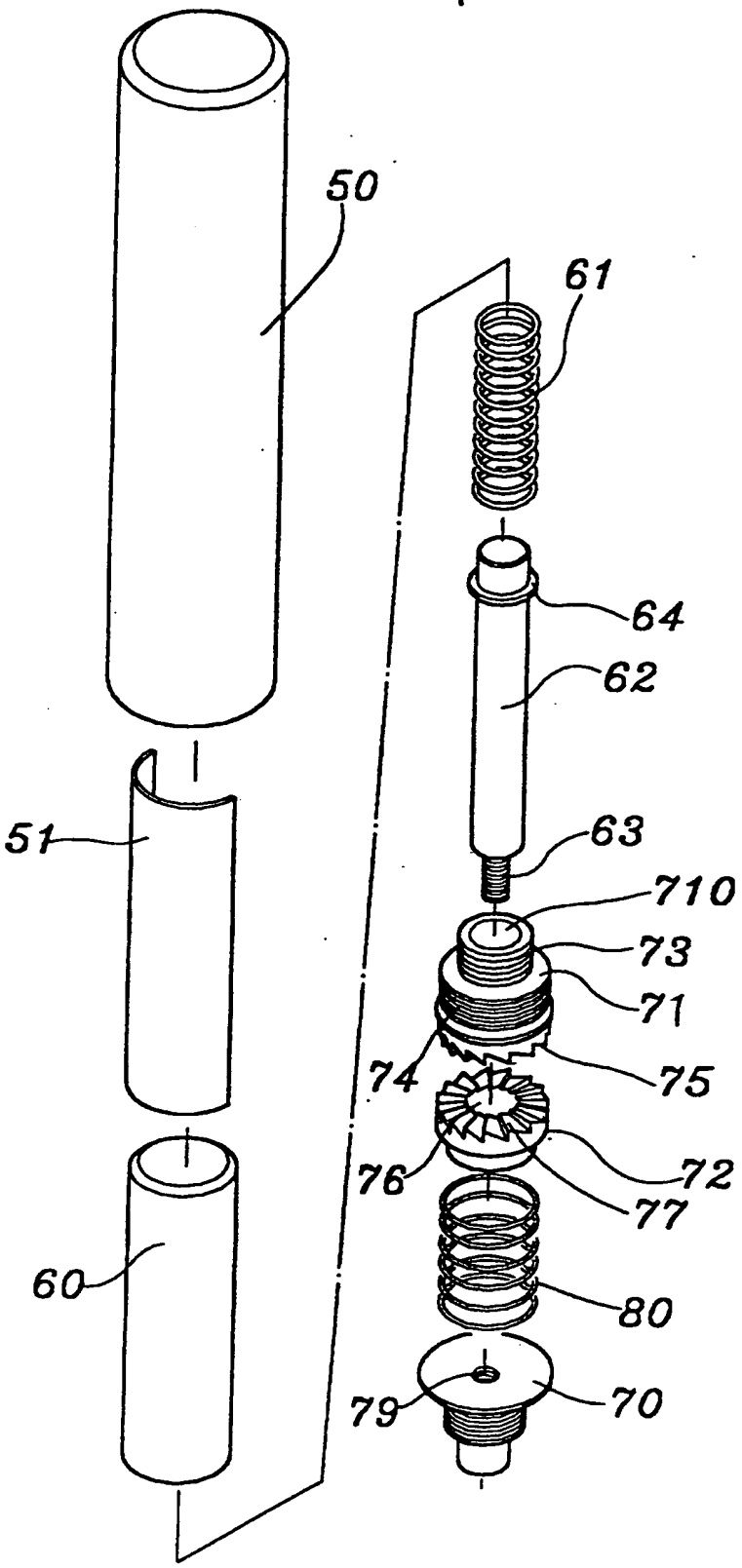

FIG. 9

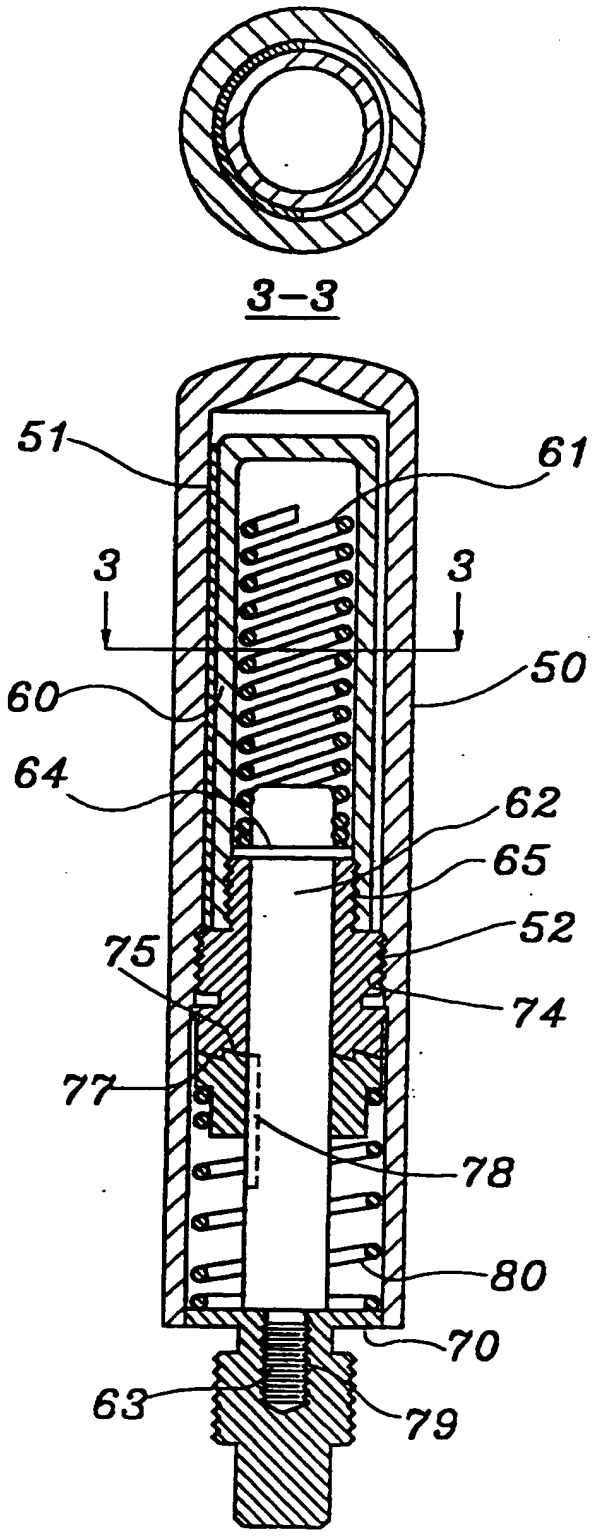

FIG. 10

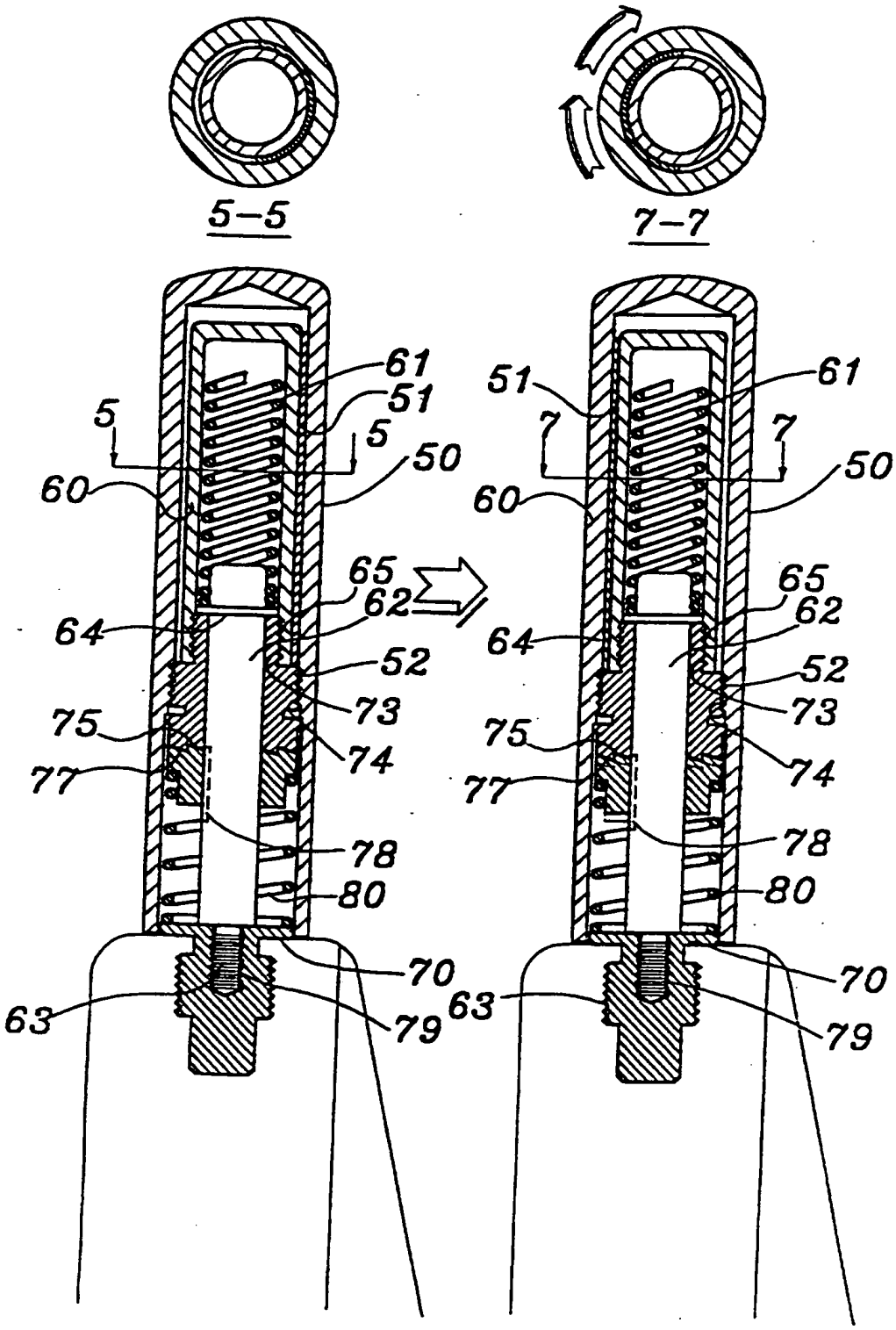

FIG. 11

FIG. 12

ANTENNA WITH RF ENERGY SHIELD FOR A PORTABLE CELLULAR TELEPHONE

BACKGROUND OF THE INVENTION

The present invention relates to an antenna for a portable cellular telephone, and more particularly to such an antenna which has shield means that limits the direction of radiation of the RF energy, preventing it from hurting the user's brain.

A portable cellular telephone uses a radio frequency energy to turn on a telephone and a switching network. The penetration of the radio frequency energy is weak to metal or building. As illustrated in Figure 1, the frequency of the antenna 11 of the GSM system portable cellular telephone 10 is 0.930GHZ, and the polarity curve 12 of the radio frequency energy of the antenna 11 is irregular. When the portable cellular telephone is closely attached to the ear during communication, the radio frequency energy is directly radiated from the antenna in direction toward the user's head. It is well known that direct contact of the head with the radio frequency energy from the antenna causes increased risk of brain cancers and the like. Therefore, the antenna must be kept away from the head at a distance when using the portable cellular telephone. However, keeping the antenna from the head at a distance affects the function of the portable cellular telephone.

SUMMARY OF THE INVENTION

The present invention has been accomplished under the circumstances in view. An antenna in accordance with one embodiment of the present invention comprises a metal shield embedded in the resin shell and covered on one half of the periphery of the antenna core. The metal shield limits the direction of the radiation of the radio frequency energy, allowing the user to closely attach the portable cellular telephone to the ear without casing a direct contact of the radio frequency energy with the brain. In an alternate form of the present invention, the metal shield can be rotated with the core and the resin shell on a mounting member which is fixedly fastened to the portable cellular telephone.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows the radiation of radio frequency energy of a portable cellular telephone according to the prior art.

Figure 2 illustrates a metal shield covered on the periphery of an antenna core according to the present invention.

Figure 3 is an exploded view of Figure 2.

Figure 4 is a front view of Figure 2.

Figure 5 is a cross sectional view taken along line 4-4 of Figure 4.

Figure 6 shows the resin shell molded on the core and the

metal shield according to the present invention.

Figure 7 is a longitudinal view in section of Figure 6.

Figure 8 is an applied view of the present invention, showing the radiation of radio frequency energy from the antenna in direction reversed to the user's head.

Figure 9 is an exploded view of an antenna according to an alternate form of the present invention.

Figure 10 is a sectional view taken of figure 9.

Figure 11 is a sectional view showing a state of the present invention where the angular position of the shield adjusted.

Figure 12 is a sectional view showing a state of the present invention where the angular position of the shield adjusted.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Figures 2 and 3, an antenna is shown comprised of a cylindrical core **20**. The core **20** has a connector **21** at the bottom end for connection the circuit in the mainframe of the portable cellular telephone, and a winding assembly (not shown) on the inside connected to the connector for transmitting/receiving radio signal. When the user uses the portable cellular telephone, one side of the core **20** (see Figures 2 and 3, line C in direction **A**) faces the user's head. The side facing the user's head is shielded with a shield **30** to stop radiation of radio frequency energy from the core **20** in direction toward the

user. The shield 30 preferably covers one half of the periphery of the core 20 in axial direction. The core 20 has two longitudinal locating grooves 22 at two sides, and a plurality of raised portions 23 arranged in a line between the longitudinal locating grooves 22. The shield 30 is made from a metal sheet, having a smoothly arched cross section, two inward coupling flanges 31;32 raised along two longitudinal sides thereof for engaging into the longitudinal grooves 22 on the core 20, and a longitudinal row of locating holes 33 on the middle for receiving the raised portions 23 of the core 20.

Referring to Figures 4 and 5, the shield 30 is resilient, and the two longitudinal sides of the shield 30 can be bent outwards for permitting the inward coupling flanges 31;32 to be moved with the shield 30 transversely over the periphery of the core 20 and then respectively forced into engagement with the longitudinal grooves 22 on the core 20. When the inward coupling flanges 31;32 of the shield 30 are respectively forced into engagement with the longitudinal grooves 22 on the core 20, the raised portions 23 of the core 20 are simultaneously forced into engagement with the locating holes 33 on the shield 30.

Referring to Figures 6 and 7, after the shield 30 and the core 20 have been fastened together, the assembly is put in a mold in an injection-molding machine (not shown), and then a resin

shell 90 is molded on the core 20 and the shield 30.

Referring to Figure 8, when the user uses the portable cellular telephone, the radio frequency energy 12 which passes out of the resin shell 90 of the antenna is prohibited by the shield 30 from radiating in direction toward the user's head.

Figures from 9 to 12 show an antenna according to another embodiment of the present invention. As illustrated in Figure 9, the antenna comprises a hollow, cylindrical, cap-like resin shell 50, a hollow, cylindrical, cap-like core 60 mounted within the resin shell 50, a shield 51 mounted on the outside wall of the core 60 within the resin shell 50, a center guide rod 62 longitudinally mounted within the core 60, the center guide rod 62 having a collar 64 around the periphery near its top end and a screw rod 63 downwardly extended from its bottom end, a winding 61 supported on the collar 64 of the center guide rod 62 within the core 60, a mounting member 70 having a top center screw hole 79 threaded onto the screw rod 63 of the center guide rod 62 for securing the antenna to the portable cellular telephone, an upper ratchet member 71 and a lower ratchet member 72 mounted around the center guide rod 62 between the collar 64 and the mounting member 70 and meshed together, and a compression spring 80 mounted around the center guide rod 62 and retained between the lower ratchet member 72 and the mounting member 70. The

compression spring **80** imparts an upward pressure to the lower ratchet member **72**, causing the lower ratchet member **72** to be forced into engagement with the upper ratchet member **71**. The upper ratchet member **71** comprises a center through hole **710** which receives the center guide rod **62**, a first outer thread **73** threaded into an inner thread **65** in the core **60**, a second outer thread **74** threaded into an inner thread **52** in the resin shell **50**, and a ratchet bottom face **75**. The lower ratchet member **72** comprises a center through hole **76** which receives the center guide rod **62**, and a ratchet top face **77** forced into engagement with the ratchet bottom face **75** of the upper ratchet member **71**.

Referring to Figures 11 and 12 again, the mounting member **70** is fixedly mounted on the portable cellular telephone, and the screw rod **63** is threaded into the screw hole **79** on the mounting member **70**. When installed, the antenna can be rotated on the mounting member **71** to change the position of the shield **51** shown in Figure 11 to the position shown in Figure 12. Because the upper ratchet member **71**, the resin shell **50** and the core **60** are fastened together, rotating the resin shell **50** causes the core **60** and the upper ratchet member **71** to be synchronously rotated relative to the lower ratchet member **72**. After adjustment, the lower ratchet member **72** is forced into engagement with the upper ratchet member **71** by the compression spring **80** again. Further,

an index may be provided at the outside wall of the resin shell 50 for indication of the position of the shield 51.

It is to be understood that the drawings are designed for purposes of illustration only, and are not intended as a definition of the limits and scope of the invention disclosed.

What the invention claimed is:

1. An antenna for a portable cellular telephone, comprising a core holding a winding assembly on the inside for receiving/transmitting radio signal, and a resin shell molded on said core, wherein said core is covered with shield means to limit the direction of radiation of radio frequency energy from said winding assembly.

2. The antenna of claim 1 wherein said shield means is made from metal.

3. The antenna of claim 1 wherein said shield means is embedded between said core and said resin shell.

4. The antenna of claim 1 wherein said shield means covers one half of the periphery of said core in longitudinal direction.

5. The antenna of claim 4 wherein said core has two longitudinal grooves at two sides; said shield means has two longitudinal coupling flanges raised along two longitudinal sides thereof and respectively forced into engagement with the longitudinal grooves on said core.

6. The antenna of claim 5 wherein said core has a plurality of raised portions longitudinally aligned in a line; said shield means has a plurality of locating holes longitudinally aligned on the middle which receive the raised portions of said core

respectively.

7. The antenna of claim 1 wherein said winding assembly comprises a center guide rod mounted within said core, said center guide rod having a collar around the periphery near a top end thereof and a screw rod downwardly extended from a bottom end thereof, a mounting member fixedly fastened to the portable cellular telephone, said mounting member having a top center screw hole into which said screw rod of said center guide rod is threaded, a winding supported on the collar of said center guide rod within said core, an upper ratchet member mounted around said center guide rod and fastened to said core and said resin shell, a lower ratchet member mounted around said center guide rod, and spring means which forces said lower ratchet member into engagement with said upper ratchet member.

8. The antenna of claim 7 wherein said upper ratchet member has a first outer thread threaded into an inner thread in said core, and a second outer thread threaded into an inner thread in said resin shell.

9. The antenna of claim 7 wherein said spring means is a compression spring mounted around said center guide rod and retained between said mounting member and said lower ratchet member.

The Patent Office

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Application No: GB 9901671.9 **Examiner:** Russell Maurice
Claims searched: all **Date of search:** 11 May 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): H1Q (QJA)

Int Cl (Ed.6): H01Q (1/24); H04B (1/38)

Other: Online: WPI, EPODOC, PAJ

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2301228 A	Samsung (see whole document, esp. fig 1, lines 11-16, 26-28, page 2 and line 27 page 4)	1, 2, 3 & 4
X	WO 95/31048	Daniels (see whole document, esp fig 10)	1, 2, 3 & 4
X	US 5694137 A	Wood (see whole document)	1, 2, 3 & 4
X	US 5373304 A	Nolan (see whole document, esp figs 1 & 2)	1, 2, 3 & 4

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.